

Claims

1. A pole structure comprising

a. a hollow pole, and

5 b. a composite dowel structure disposed at least partly in the hollow pole structure;

the composite dowel structure comprising

i. a high tensile strength material disposed at least partly in the hollow pole, and

10 ii. a high tensile strength epoxy resin aggregate substantially filling a predetermined portion of the hollow pole that includes a predetermined portion of the high tensile strength material.

2. A pole structure as set forth in claim 1, wherein the high tensile strength

15 material comprises a fabric sleeve disposed next to the interior wall of the hollow pole, and the high tensile strength epoxy resin aggregate saturates a predetermined portion of the fabric sleeve and incorporates the predetermined portion of the fabric sleeve into the composite dowel structure.

20 3. A pole structure as defined in claim 2, wherein the fabric sleeve comprises a fiberglass sleeve next to the interior wall of the pole, and a carbon sleeve inside and next to the fiberglass sleeve.

25 4. A pole structure as defined in claim 2, wherein the pole includes an in ground portion and an above ground portion, wherein the high tensile strength material is disposed at partly in the in ground portion of the hollow pole, and wherein the high strength epoxy resin aggregate substantially fills a predetermined portion of the hollow pole that includes a predetermined portion of the high tensile strength material disposed at least partly in the in ground portion of the hollow pole.

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5. A pole structure as defined in claim 4, wherein the pole comprises a metal material and the above ground portion of the pole includes an access hole disposed

above a predetermined depth of good metal of the pole, and wherein the fabric sleeve extends to the access hole.

6. A pole structure as defined in claim 5, wherein the metal material has a deteriorated portion that extends at least partially into the in ground portion of the pole, and wherein the composite dowel structure is configured to reinforce the pole in the area of the deteriorated portion of the metal material.

5 7. A pole structure as defined in claim 6, further including a wrapping about predetermined portion(s) of the pole, to contain the composite dowel material in the pole.

10 8. A pole structure as defined in claim 4, wherein the pole has a deteriorated portion that extends at least partially into the in ground portion of the pole, and wherein 15 the composite dowel structure is configured to reinforce the pole in the area of the deteriorated portion of the pole.

15 9. A pole structure as defined in claim 8, further including a wrapping about predetermined portion(s) of the pole, to contain the composite dowel material in the 20 pole.

10. A method for repairing, in situ, a hollow support structure that has a deteriorated portion and an access opening, comprising the steps of

- 25 a. placing a high tensile strength material in the hollow support structure, to at least a depth such that the high tensile strength material extends over the depth of the deteriorated portion,
- b. pouring an aggregate material into the hollow support structure, to incorporate the high strength material into the aggregate that fills the hollow support structure at least over the depth of the deteriorated portion, and
- 30 c. allowing the aggregate to cure, in situ.

11. A method as set forth in claim 10, wherein the hollow support structure has an in ground portion and an above ground portion, and wherein the hollow support

structure has a deteriorated portion extending at least partially into the in ground portion, and an access opening in the above ground portion.

12. A method as set forth in claim 11, wherein

5 a. the step of placing a high tensile strength material in the hollow support structure comprises providing a fabric sleeve having a mouth, placing the fabric sleeve through the access opening, forcing the sleeve into the in ground portion to at least an in ground depth that extends over the depth of the deteriorated portion, and locating the mouth of the sleeve in the access opening, and

10 b. the step of pouring the epoxy resin aggregate into the hollow support comprises pouring the epoxy resin aggregate through the mouth of the sleeve, in an amount and to a depth such that the epoxy resin aggregate saturates the fabric sleeve and fills the hollow support structure at least over the depth of the deteriorated portion, and the epoxy resin aggregate extends 15 to the mouth of the fabric sleeve located in the access opening.

13. A method as set forth in claim 12, wherein the step of forcing the sleeve into the in ground portion of the hollow support structure comprises tying off the sleeve,

20 inserting a rod into the sleeve and using the rod to push the sleeve into the hollow support structure to a predetermined depth.

25 14. A method as set forth in claim 12, wherein the aggregate comprises an epoxy resin aggregate that is mixed from the following materials; sand, gravel, saturating epoxy and epoxy hardener.

15. A method as set forth in claim 14, wherein the epoxy resin aggregate is mixed in the following relative proportions: 24% saturating epoxy, 12% epoxy hardener, 33% sand and 33% gravel

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16. A method as set forth in claim 10, including the further step of wrapping predetermined portion(s) of the hollow support structure, to contain the composite dowel material in the hollow support structure.

17. A method as set forth in claim 16, wherein the step of wrapping the exterior of the hollow support structure proceeds the step of pouring epoxy resin aggregate into the hollow support structure.

5 18. A method of forming, in situ, a dowel structure that reinforces a portion of a hollow support structure, comprising the steps of;

- a. determining the depth of the portion of the hollow support structure that is to be reinforced,
- b. placing a high tensile strength reinforcement component inside the hollow support structure such that the high tensile strength reinforcement component extends at least over the depth of the portion of the hollow support structure that is being reinforced, and
- c. pouring into the hollow support structure an epoxy aggregate that substantially fills the hollow support structure at least over the depth of the portion of the hollow support structure that is being reinforced, and allowing the epoxy aggregate to cure in situ.

15 19. A method of forming, in situ, a structure that reinforces a deteriorated portion of a hollow support structure, the hollow support structure being disposed partly in a medium (such as the ground or an aqueous medium) and partly above the medium, comprising the steps of;

- a. determining the depth of the deteriorated portion of the hollow support structure to be reinforced,
- b. saturating a high tensile strength fabric with a high strength epoxy material, and
- c. wrapping the saturated high tensile strength fabric about the hollow support structure such that the high tensile strength fabric extends at least over the depth of the deteriorated portion of the hollow support structure that is being reinforced, and allowing the high strength epoxy material to cure, in situ.

20 30 20. A method as set forth in claim 19, including the further step of pouring an epoxy resin aggregate into the hollow pole structure, to at least a depth such that the

epoxy resin aggregate fills the hollow pole in the area that encompasses the deteriorated portion, and allowing the epoxy resin aggregate to cure, *in situ*.

21. A method for preparing a hollow support structure for incorporation of a composite dowel structure into the hollow support structure, comprising the steps of

- 5 a. providing a fabric sleeve of high tensile strength fabric having a mouth,
- b. placing the fabric sleeve through an access opening in the hollow support structure,
- c. forcing the sleeve into the hollow support structure to a desired depth, and,
- 10 d. locating the mouth of the sleeve in the access opening, so that an epoxy resin aggregate can be poured into the hollow support structure through the mouth of the sleeve and to the desired depth.

15 22. A method as set forth in claim 21, wherein the step of forcing the sleeve into the hollow pole comprises inserting a rod into the fabric sleeve and pushing the rod into the hollow pole, to push the sleeve into the in ground portion to the desired depth.

20 23. A method as set forth in claim 22, including forming the sleeve of a carbon sleeve part disposed inside a fiberglass sleeve part.